SOIL SURVEY OF CERRO GORDO COUNTY, IOWA.

By HERBERT W. MAREAN and GROVE B. JONES.

LOCATION AND BOUNDARIES OF THE AREA.

Cerro Gordo County is situated in the middle northern part of the State of Iowa. It is separated from the Minnesota boundary by Worth County, which lies to the north. Mitchell and Floyd counties bound it on the east, while Franklin and Hancock counties form, respectively, the southern and western boundaries. It embraces an area of approximately 567 square miles, or 362,944 acres.

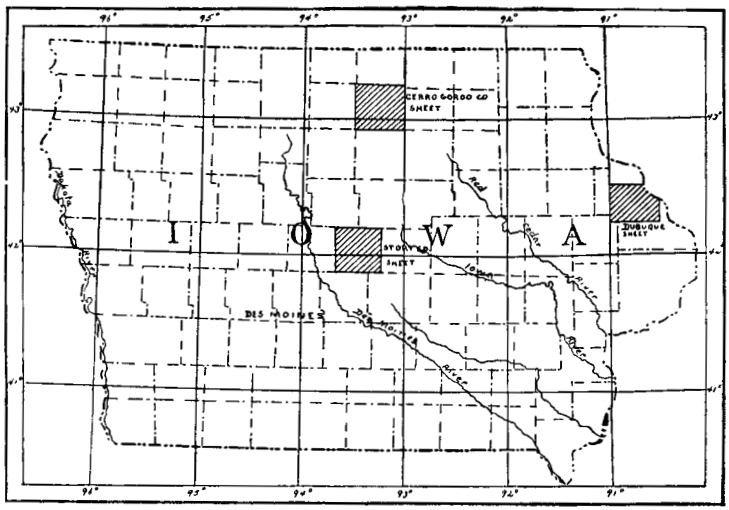

FIG. 42.—Sketch map showing location of the Cerro Gordo County area, Iowa.

The county lies about 350 miles west of Chicago and 140 miles south of Minneapolis. Mason City, the county seat—a town of about 7,000 inhabitants—is a railroad center of considerable importance.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The history of the development of that part of Iowa embraced under the present survey covers a period of only a half century. But the few decades which have elapsed since the occupation by the whites have been marked by steady, rapid growth, until to-day the broad prairies of fifty years ago, covered by tall wild grass and seldom

visited even by the red men, have become a thickly settled agricultural region—one of the most prosperous farming sections of our country.

The first settlement in Cerro Gordo County was made in 1851 by Joseph Hewitt and James Dickerson, two pioneers from Clayton County. The purpose of their expedition was to hunt the buffalo calves and elk which abounded in this region, and they threw up rude huts on the shores of Clear Lake for shelter during the winter season. After passing the winter under the severe hardships that the pioneer must undergo, they decided to remain and take up claims to some of the fertile lands. Their little settlement was many miles from the nearest habitation of whites, and such provisions as could not be supplied from hunting and fishing had to be carried long distances in wagons. Such things as groceries and clothing had to be brought from Dubuque, 150 miles away.

In the spring of 1852 Elijah Wiltfong settled on the Shell Rock River and took up claims to the water power at Rock Falls. Others followed soon after, among whom were John B. Long and John Biford, who settled near the present site of Mason City, where they made claim to an extensive timber tract and called it Masonic Grove. Late in the season of 1853 a small town was laid out upon a part of the area now occupied by Mason City. This was called Shiboleth by the proprietors who laid claim to the land. In the fall of that year a log cabin, the first building to be erected upon the town site, was constructed.

From time to time the number of settlers was increased by the arrival of more immigrants, and all seemed progressing with a promise of rapid settlement and development of the country, but in the summer of 1854, when the crops were all in and the harvest approaching, there came the news of Indian troubles. The settlers fled to the neighboring counties for protection, and upon returning after quiet had been restored found that all their crops and stores had been plundered during their absence. However, the following winter was mild, so there was not so much suffering as there might otherwise have been, and with the return of another spring these early settlers took up again the task of tilling the soil which they had sacrificed so much to obtain.

The land was obtained by purchase from the Government. The nominal sum of $1.25 an acre was paid, and there was practically no limit to the amount one person might acquire. When the tide of immigration was once started the country was very rapidly settled, and a large part of the best land was taken up by the beginning of the sixties.

The character of the agriculture has not greatly changed. Stock-raising and the extensive production of grain and grass have been and are still the chief interests. In the early days, however, a good deal

of wheat was raised, but as this was found to be less profitable than corn and oats it was soon abandoned, until to-day practically none is grown within the county. Dairying and the keeping of poultry have become important in late years, and promise to become still more so in the future.

And it is to be expected that as the country as a whole becomes more thickly settled and there is more demand for food stuffs to supply the needs of an increasing population, agricultural methods will assume a more intensive character in such a region as that covered by the present survey, where the great productiveness of the soil insures a large yield per acre of a wide variety of crops.

CLIMATE.

That portion of the State of Iowa under consideration belongs to the belt of country lying between the humid and semiarid regions. The table below is compiled from the records of the Weather Bureau stations located at Britt, Charles City, and Osage, the first west and the last two just east of the area surveyed, and shows the normal monthly and annual temperature and precipitation. It will be seen that the annual precipitation is none too plentiful for the production of the staple crops. It is, however, favorably distributed through the year, the months of the growing season receiving the larger proportion of the rainfall. Furthermore, the peculiar character of the soils, their property of retaining moisture, offsets to a large degree any shortage in the annual precipitation. As a matter of fact during the last two seasons a loss of crops has been caused not by too little but by too much rainfall.

Normal monthly and annual temperature and precipitation.

Month.	Britt.		Charles City.		Osage.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	° *F.*	*Inches.*	° *F.*	*Inches.*	° *F.*	*Inches.*
January	17.5	0.60	15.5	1.16	13.6	0.91
February	17.2	.87	14.9	1.31	14.4	1.20
March	27.3	1.51	29.3	1.71	26 6	1.60
April	47.0	2.29	47.4	3.07	45.6	2.68
May	58.5	3.16	58.3	3.63	56.8	3.85
June	68.5	4.60	68.7	4.79	66.8	4.30
July	73.0	3.61	73.8	2.81	70.8	3.33
August	70.4	2.96	71.4	2.58	67.7	2.92
September	62.5	3.68	63.1	2.88	59.5	3.60
October	52.0	2.38	50.5	2.13	46.7	2.51
November	32.3	.72	30.7	1.34	28.4	1.42
December	17.1	.56	20.4	1.19	19.3	1.21
Year	45.3	26.94	45.3	28.60	43.0	29.53

The long, severe winters of the Northwest enter as an element in the agriculture of the country. Those not accustomed to extremes of climate are liable to undergo considerable hardship, and it is necessary to make thorough provision for the housing of stock, as otherwise there would be loss. But, on the whole, the climate of Cerro Gordo County is favorable to those branches of agriculture at present in practice and a wide range of crops, including some that are not at present grown in this locality, is well adapted to the conditions of the country.

The average date of last killing frost in spring is May 2 at Charles City, May 14 at Britt, and May 12 at Osage. The first in fall occurs usually September 28 at Charles City, September 23 at Britt, and September 28 at Osage. This gives a mean growing season of 139 days.

PHYSIOGRAPHY AND GEOLOGY.

The geological formations of Cerro Gordo County belong to two very widely separated geological ages. The indurated rocks of sedimentary origin belong to the Paleozoic era. These are mostly limestones or calcareous shales, many of which contain large quantities of fossil shells. Strata belonging to the Middle Devonian system underlie all of the northern and eastern parts of the county. The beds lie almost horizontal, dipping slightly toward the southwest. The southwestern boundary of these strata passes just south of Mason City, where the Cedar Valley limestones dip under the beds of the calcareous Lime Creek shales. These latter, in turn, dipping slightly southwestward, disappear below the strata of the Kinderhook limestones, which belong to the Lower Carboniferous period.

Outcrops of the country rock are quite common in the eastern part of the county. Here the covering of unconsolidated material is comparatively thin, ranging from 2 or 3 feet along some of the valley slopes to 25 or 30 feet. Hard strata are exposed in many places along the major stream courses, and it is not uncommon to find the bare limestone exposed in the bed of the road in parts of Mason, Lime Creek, and Falls townships.

Although the soils of Cerro Gordo County are glacial in origin, and have little relation to the underlying rock, it is not unlikely that where the coating of till is so thin as it is in some cases, a considerable part of the material which makes up the body of the soil is of local derivation, and though mingled with foreign substances is composed largely of the ground-up product of underlying rocks. However, areas where this is the case are comparatively limited in extent.

Deposits referable to the various stages of the Glacial period form the superficial covering of practically the whole county. Evidences exist which point to the fact that the territory was occupied by Kansan

ice, which is one of the earliest stages of glacial times. The period following the Kansan, known as the Buchanan, is represented by the sands and gravels that form the subsoils of the Lime Creek terraces and play an important rôle in determining the character of one of the soil types. Nearly three-fourths of the county is covered by a sheet of glacial till belonging to the Iowan stage. The western tier of townships is covered by material belonging to the Wisconsin stage, which was deposited by a later ice sheet and which is undoubtedly underlain by the Iowan till. The Iowan drift differs considerably from the Wisconsin deposits. It is comparatively thin, as already stated, ranging from 2 or 3 feet to 20 or 25 feet, but seldom exceeding this depth. The material is a yellow clay mixed with sand, gravel, and bowlders, and shows even at the surface no great degree of oxidation. The pebbles and bowlders are chiefly of granite, and for the most part unweathered. Bowlders of this rock, some of exceedingly large dimensions, are scattered over the surface of the country. These are seldom so plentiful as to cause trouble, but several large fields were observed in the southern part of Lincoln Township, where the bowlders were so numerous as to make cultivation impossible.

The Wisconsin drift ranges from 100 to 175 feet in thickness. The material is also a yellow clay, showing less weathering than the Iowan. Bowlders are numerous, but on the whole smaller than those which characterize the Iowan sheet, and there are rather more pebbles and fragments of rock in the former than in the latter.

To the casual observer the physiography of Cerro Gordo County would present little of interest. The topography is remarkably uniform throughout the greater part of the area. The surface is that of an undulating prairie with remarkably few salient features.

Lime Creek forms the main drainage channel of the area, and with its tributaries drains the larger part of the county. This stream occupies a preglacial channel which at a former age probably accommodated a larger stream than that now flowing through it. Through the influence of the Wisconsin drift, which has rendered stagnant much of its headwater drainage, and partly through the influence of the postglacial stream, Shell Rock River, which has doubtless captured some of its territory, Lime Creek has decreased in volume and importance as a drainage channel.

In connection with the description of this stream one interesting feature should be mentioned. This is the abandoned channel cut in bed rock a little north of Mason City. This channel is seldom more than 100 yards wide and is not at present occupied by a stream of any consequence, but is filled with muck and peaty deposits. Its location can be seen by reference to the accompanying map, where it is indicated by a narrow strip of Muck. This channel was undoubtedly excavated by Lime Creek at some time preceding the Iowan stage.

The main valley, which lies to the westward, was temporarily blocked and for a comparatively brief period the stream pursued this new course, cutting down rapidly into the limestone strata, but not having time to widen its trough at all. Later the old channel was opened up again and the stream resumed its former course.

Shell Rock River, which crosses the northeast corner of the county in a generally southeasterly direction, is almost, if not quite, equal to Lime Creek in the volume of water which it carries. It shows unmistakable signs of comparative youth in the character of its valley. It flows in a narrow trough without flood plain or broad, sloping valley walls. In some places the upland prairies seem to begin at its very banks, and stretch away with comparatively little ascent. In other cases there seem to be faintly defined valley walls some distance from the present stream, as, for instance, at the railroad crossing southwest of Plymouth, and again, to the east of the Burlington, Cedar Rapids and Northern Railroad, where the stream leaves the county in Portland Township.

The chief tributaries of Lime Creek are Spring Branch, Calmus Creek, and Willow Creek. The first enters the county from the north and flows south through the middle of Lime Creek Township. The latter two rise in the marshy sloughs of the eastern border of Grant and Clear Lake townships and flow eastward, emptying into the main stream near Mason City.

Beaver Dam Creek with its tributaries furnishes drainage for most of the southern townships.

In the belt occupied by Wisconsin drift in the western border of the county, glaciation has left its stamp plainly marked upon the country. The broad belt of broken country marking the eastern marginal moraine of this ice lobe has been called the Altamont Moraine. This moraine belt is marked by an exceedingly hummocky topography throughout much of its course. Especially typical is the kame-and-kettle surface of northern Grant Township. Small knoblike eminences are scattered about with absolutely no order or system. The intervening spaces between these knobs are generally undrained, boggy spots of varying size and shape. Thousands of these are found dotting the surface of the country within the moraine belt, and the area is practically undrained. Streams are exceedingly scarce; the rain water must find its way through tortuous sloughs and marshes or stand in ponds and puddles until it is evaporated. Ponds in which the water remains the year around are numerous. Clear Lake itself is merely a large kettle hole, fed by springs and seepage from the neighboring highlands.

In the western portion of Union and Grimes townships the surface becomes less broken, grading off into the featureless prairie which characterizes interior areas of Wisconsin drift.

The general level of the county, according to figures given in Gannett's Dictionary of Altitudes, ranges from 1,071 to 1,252 feet above sea level.

SOILS.

In Cerro Gordo County there are seven different soil types, including Muck and Meadow, but two-thirds of the entire area of the county is occupied by one type, the Marshall loam, and 85 per cent of the surface by the type just mentioned and the Marshall clay loam together. The extent of each of these soils, in acres, is given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Marshall loam	242,112	66.7	Meadow	3,456	1.0
Marshall clay loam	67,456	18.6	Marshall sand	1,024	.3
Sioux sandy loam	32,768	9.0	Total	362,944	.....
Muck	12,096	3.3			
Miami black clay loam	4,032	1.1			

MARSHALL LOAM.

Of the types of soil found in Cerro Gordo County the Marshall loam covers the largest area and is first in agricultural importance. It is one of the most widely distributed types of the prairie soils occurring in many other localities of the northwestern prairie district.

The soil is a rather black or dark-brown loam, rich in organic matter, and of a mellow texture. It contains considerable quantities of sand of all grades of coarseness, and this distinguishes it from the heavier Marshall clay loam. The subsoil is a dark-brown clay loam, more plastic and claylike than the soil, and at an average depth of about 24 inches a rather stiff yellow or light-brown clay is met, gritty with coarse sand and sharp fragments of decomposing rock. The deep subsoil consists of clay, sand, gravel, and bowlders, mingled together in a disorderly mass as they were originally deposited by the glacial ice. This glacial drift, in which clay predominates, is of a yellow color even within a few feet of the surface, and extends to a depth varying from 20 to 175 feet.

The above is a description of a typical sample of Marshall loam. The soil, however, varies considerably in different parts of the county, and even within limited areas there are marked changes in the depth and physical character of both soil and subsoil. The average depth of the black humus coating, which is generally spoken of as the "soil," is about 18 inches. Where the surface of the country is rather rolling this will vary from 7 or 8 to 24 inches or more, the higher parts being shallower and more sandy, while the depressed

areas are deep, black, and somewhat heavier. Such areas are found in the western part of the county, within the limits of the Altamont moraine, and in other localities where the surface is rolling and hummocky. Here the soil is, on the whole, shallower and more sandy, and the grade of sand is generally a little coarser than is found in areas of more even topography. A gravelly phase occurs quite frequently in the moraine districts. Small patches of gravel, found usually on the crests of the knobs and knolls, are numerous in parts of Grant Township, in the northwest corner of the county, and where groups of these are to be found covering any considerable areas their location is indicated upon the soil map by the gravel symbol. It should be understood, however, that the gravel is not continuous over the whole of these areas, but occurs in limited patches. Pockets of yellow or reddish sand and gravel are often found in the subsoil.

In the eastern half of the county the Marshall loam is rather more uniform in character and the sand is of a somewhat finer grade, where it approaches most nearly to the type of the Marshall clay loam. Here it is not uncommon to find a sandy or gravelly subsoil at a depth of 3 feet or more. The deep subsoils of this type are yellow sandy clays.

The Marshall loam is found in all parts of the county. Its total area is 242,112 acres, or 66.7 per cent of the entire area surveyed. In the western half of the county it occurs almost to the exclusion of all other types, while in the eastern division it is the most widespread of the upland soils.

In origin it is a glacial soil, belonging in part to the Wisconsin and in part to the Iowan drift. Mingled with the sands and clays are many pebbles and bowlders, some still showing the marks and striations of glaciation. These are of various rocks, granite, "greenstones," and limestones predominating. Large bowlders are seen scattered here and there over the surface throughout the entire area, and in a few cases they become very plentiful, as in sections 33 and 34 of Lincoln Township. As a rule they have been removed from the fields wherever they interfered with cultivation.

The Marshall loam is on the whole a poorly drained soil, owing to its peculiar topography. The physical character of the soil itself is not such as would prevent good drainage under more favorable conditions of topography, but there are innumerable little ponds and sloughs, especially in the moraine areas, where there are scarcely any surface streams to carry off the surplus rain water. In wet seasons many of these little saucerlike depressions contain standing water. Seepage and evaporation are the only natural means of escape for such emponded water, and artificial methods must be resorted to if such low-lying areas are to be put under cultivation. This can sometimes be done profitably and a great deal of land is now equipped with a

system of tile drains. But drainage in some cases can not be carried on economically at the present value of land, for it may be necessary to carry the outlet drain so far to procure the proper fall that the cost of construction would exceed the value of the land when reclaimed. However, a large percentage of this soil would be benefited by a good, properly constructed system of underdrains, and the farmers are generally alive to this fact.

The crops chiefly grown on the Marshall loam are corn, oats, and hay. Corn yields about 40 bushels per acre, the average ranging from 25 to 60 bushels per acre, according to the season. Oats form a very important part of the product of this soil; they yield about 40 bushels per acre on the average. Other cereals of inferior importance are buckwheat and barley, while flax is grown to some extent. All the varieties of grass and clover suited to this climate do very well upon the Marshall loam. Timothy and clover, generally sown together, are most extensively grown. The average yield is about $1\frac{3}{4}$ or 2 tons per acre, with occasional crops of 3 or 4 tons to the acre. Bluegrass and white clover are the principal pasture grasses, and as stock raising is an important interest a large total acreage is devoted to grazing.

Fruit and vegetables are grown for home consumption in all parts of the county upon this variety of soil; apples, plums, cherries, and grapes, with small fruits and berries, are among those which produce the best results. Irish potatoes and most varieties of market-garden crops can be successfully grown, and though at present they are produced chiefly to furnish the houshold needs, the time may come when they will be more extensively grown.

The following table shows the mechanical composition of the fine earth of typical samples of this soil:

Mechanical analyses of Marshall loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9503	Sec. 10, Owen T..	Loam, 0 to 18 inches.	2.97	0.64	7.70	10.68	15.84	7.74	33.24	24.16
9501	Sec. 10, Geneseo T.	Loam, 0 to 15 inches.	2.92	.80	7.86	9.66	15.32	5.46	33.62	26.90
9504	Subsoil of 9503....	Sandy clay, 18 to 36 inches.	1.32	.64	7.96	10.80	15.96	11.64	33.00	20.04
9502	Subsoil of 9501....	Sandy clay loam, 15 to 36 inches.	.87	2.40	9.96	9.70	18.44	7.40	25.70	26.40

MARSHALL CLAY LOAM.

The Marshall clay loam stands next in importance and extent to the Marshall loam, covering, as it does, 18.6 per cent of the entire area surveyed. The soil is a rather heavy loam, in which scarcely any of the coarser grades of sand can be detected. When moist the soil is black and plastic, and feels smooth when rubbed between the fingers. Upon drying it becomes mellow and friable, and the particles of fine sand are more easily discernible. This black humus soil is underlain at an average depth of 12 inches by a brown clay loam, changing to a yellow plastic clay which is somewhat gritty with coarse material. The subsoil of Marshall clay loam is somewhat like that which underlies the Marshall loam, though on the whole it is heavier and less sandy. It also differs from the Marshall loam in being underlain, usually at a depth of 3 or more feet, by a yellow, sticky sand or sandy clay, the sand consisting largely of small, round particles of limestone. These subsoils rest upon the hard strata of rock at a depth seldom exceeding 8 or 10 feet, while in some places the beds of limestone outcrop at the surface, or come so near the upper soil that the farmer, in plowing, stirs the decaying fragments of the underlying rock.

Although the Marshall clay loam and the Marshall loam possess some points of resemblance, they differ in several important features. The Marshall clay loam is a heavier soil, containing less sand in the soil and subsoil than the Marshall loam. It is quite uniform throughout the entire area, whereas the Marshall loam varies considerably within a limited area. The material of Marshall clay loam, like that of Marshall loam is of glacial origin, but from the total depth of soil, which seldom exceeds 8 or 10 feet, and from the resemblance of this material to the underlying rock, it can be pretty safely stated that much of the material making up the soil of Marshall clay loam is the product of the underlying limestones and shales ground up and commingled by the glacier.

Another feature in which Marshall clay loam differs from Marshall loam is in its more perfect drainage. This is due in part to its topographic character and in part to the sandy stratum which generally underlies the soil. Only a thin veneering of glacial débris was spread over the country when the soil was formed, and so the topographic features and drainage lines are much the same as they were in preglacial times. Only in a few low-lying areas along stream courses is this soil in need of artificial drainage.

Inasmuch as the change from clay loam to loam in the field is very gradual and seldom marked by abrupt transitions, it should be borne in mind that what is indicated on the soil map as a boundary line between Marshall clay loam and Marshall loam does not as a rule denote an abrupt change from the one soil to the other, but rather

that this is the mean or middle stage in the almost imperceptible change, which may spread over a breadth of a mile or more.

The occurrence of Marshall clay loam is practically limited to the eastern half of the county. It occupies strips and patches of considerable extent in the upland of the Iowan drift area, the largest single areas occurring north and south of Mason City, in Lime Creek and Mason townships. None of it is found in the Wisconsin drift area along the western border of the county.

All the varieties of crops to be found in the area surveyed are grown upon the Marshall clay loam. Corn, oats, and grass constitute nine-tenths of these products. The soil is an ideal corn and hay soil, the yields per acre varying from 25 to 60 bushels of corn and from 1 ton to 4 tons of hay. The soil is better adapted to grass than either the Marshall loam or the Sioux sandy loam. Bluegrass makes a luxuriant pasturage; the soil is exceedingly retentive of moisture, and in texture is sufficiently compact to hold sod well. The raising of stock and dairying are important interests carried on upon the Marshall clay loam, and the success of these branches of farming proves how well adapted are the conditions to them. Fruit and vegetables, and in fact all crops favored by the climate of this country, can be profitably grown upon this soil type.

The following table gives mechanical analyses of typical samples of the soil and subsoil of the Marshall clay loam:

Mechanical analyses of Marshall clay loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9497	Sec. 36, Owen T..	Clay loam, 0 to 14 inches.	4.86	0.10	1.24	2.10	4.54	6.80	55.40	29.10
9495	Sec. 33, Geneseo T.	Clay loam, 0 to 14 inches.	3.79	.80	7.00	8.80	14.18	5.42	33.20	29.90
9493	Sec. 27, Lime Creek T.	Clay loam, 0 to 12 inches.	5.17	.70	5.20	5.00	7.30	5.20	44.60	31.68
9498	Subsoil of 9497....	Clay loam, 18 to 30 inches.	1.45	Tr.	1.16	1.50	3.28	10.96	53.76	29.10
9496	Subsoil of 9495....	Clay loam to clay, 14 to 36 inches.	1.46	.86	8.20	10.20	15.68	6.18	27.88	31.00
9494	Subsoil of 9493....	Clay loam, 12 to 36 inches.	2.00	1.30	5.68	5.68	9.08	5.70	40.80	31.40

The following sample contained more than one-half per cent of calcium carbonate ($CaCO_3$): No. 9498, 2.74 per cent.

SIOUX SANDY LOAM.

The surface appearance of the Sioux sandy loam is quite similar to that of the Marshall loam of the upland. It is a black sandy loam, usually rather coarse in texture, but loamy and coherent, with a high percentage of included organic matter. The mechanical analyses of the samples may not show a much larger proportion of the sand groups than is contained in the Marshall loam, but the fact that there is more coarse sand present gives this type the field qualities of a more distinctively sandy soil. Close examination shows the coarser particles to be well rounded, as if they had been subjected to water action. This is an indication of the origin of the soil, to which reference will be made later. The depth to which the black humus soil extends is generally about 12 inches, below which it grades into a brown sandy clay loam, becoming heavier with the increasing depth, until the coarse, porous subsoil of sand and gravel is reached. It is remarkable to note with what uniformity of depth this gravelly subsoil is found to occur. Though in some cases the depth varies from 18 to 36 inches, in a large majority of cases the soil auger enters the gravel beds at exactly 2 feet below the surface. The nature of this subsoil, however, is quite variable. In many instances the change from a heavy clay loam to a mixture of fine gravel and coarse sand is quite abrupt. Again, the deep subsoil may be composed of orange sand of a rather uniform texture, and without admixture of heavier material. In still other cases particles of all grades of fineness from clay to gravel are mingled together in a heterogeneous mass. It is not common, however, to find this type possessing a subsoil sufficiently compact to sustain capillary connection between the lower ground waters and the soil above.

In several localities the sand and gravel underlying the Sioux sandy loam have been excavated for road material or railway ballast, exposing the deeper subsoil and affording an excellent opportunity to study the lower lying strata. Such soils always reveal beds of sand and gravel, mingled or interstratified, and marked by that peculiar cross-bedded structure characteristic of delta or river deposition. Coarse material predominates, and the layers are usually of coarse sand or gravel, without matrix or finer particles, giving evidence of rapid deposition. The material itself is composed of crystalline particles, evidently of glacial origin, quartz, "greenstones," and granite pebbles predominating.

The Sioux sandy loam, in area and agricultural importance, ranks third among the types which occur in Cerro Gordo County. It is found occupying low-lying level strips along the larger streams and a few of their tributaries. By far the largest area occurs as terraces along Lime Creek. A strip in Lime Creek and Lincoln townships, stretching in a belt about 2 miles broad along the north bank of the stream,

possesses the typical river terrace topography. The country here ascends by two or three low rises, the floor of each step being inclined toward the stream, until the north boundary of the old valley is reached, where there is generally a low bluff separating this type from the low, rolling hills of the prairie. No such extensive areas of the Sioux sandy loam are found along the borders of Shell Rock River, though there are two small patches, one in the northwest part of Falls and the other in the northeast corner of Portland townships. From Mason City to the southeastern corner of Portland Township, where it leaves the county, Lime Creek is flanked by a belt of this terrace type. Smaller areas occupy the narrower bottoms of Willow and Calmus creeks in the northern and Beaver Dam Creek in the southern part of the county.

In drainage conditions the Sioux sandy loam varies somewhat according to its topographic features. From the standpoint of its physical structure the Sioux sandy loam is a perfectly drained soil. The open and porous subsoils of gravel and sand which lie within 2 or 3 feet of the surface, and which extend to considerable depths below, furnish a ready outlet for the rain water. Indeed, the greater area of this type of soil is so completely drained that it suffers materially in times of drought. This is true of practically all those areas which form the terraces of Lime Creek. Here the floor of the terrace is so high above the present stream bed as to maintain a considerable fall in the natural drainage, and so a low level of the underground water obtains in seasons of ordinary rainfall; but along some of the smaller streams, where the belt of this type is quite narrow and the terrace rises but little above the level of the stream, seepage from the neighboring upland affords a plentiful supply of moisture, and in such cases this type may be wet and in need of artificial drainage. This condition, however, is the exception rather than the rule.

It is stated that this soil is about two weeks earlier than any of the other types in the county. Being so perfectly drained, it is warmer in the spring and can be cultivated earlier, and for this reason is more desirable for certain crops. On the other hand, crops grown upon the Sioux sandy loam are very apt to suffer in dry weather, this type being exceedingly sensitive to drought. In seasons of such abundant rainfall as have occurred in the last two years, however, crops will do better upon this soil than on the less perfectly drained uplands.

All the crops of the county are grown upon the Sioux sandy loam and fair average yields are obtained. Corn varies from 25 to 60 bushels per acre, with an average of about 35 bushels. Oats, grass, and barley also do well, and small fruits and vegetables are quite extensively grown in the neighborhood of Mason City to supply the local market. It is thought that small fruits and vegetables for canning could be made a paying industry upon this soil, as well as orchard fruit and grapes.

The following table shows the texture of typical samples of the fine earth of this soil:

Mechanical analyses of Sioux sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.05 to 0.1 mm.	Very fine sand, 0.1 to 0.25 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9511	Sec. 3, Mason T...	Heavy sandy loam, 0 to 12 inches.	2.28	4.80	14.68	7.74	9.84	3.40	37.70	21.80
9513	Sec. 28, Lime Creek T.	Sandy loam, 0 to 15 inches.	3.13	2.20	12.48	13.04	16.68	4.80	26.50	23.80
9515	Sec. 17, Geneseo T.	Coarse sandy loam, 0 to 14 inches.	2.46	3.30	14.24	12.44	15.18	4.20	21.28	28.80
9512	Subsoil of 9511....	Sandy loam, 12 to 36 inches.	.81	11.50	29.40	13.00	16.90	4.86	10.30	14.06
9514	Subsoil of 9513....	Sandy loam, 15 to 36 inches.	.42	3.00	11.60	16.90	29.40	8.24	13.34	17.10
9516	Subsoil of 9515....	Sandy loam, 14 to 36 inches.	.93	5.60	18.94	16.80	20.08	4.06	15.50	19.16

MUCK.

A very characteristic feature of the western or moraine section of the county is the frequent occurrence of marshy and swampy depressions. These have already been referred to in the chapter on Physiography and Geology, and also in the discussion of the Marshall loam. Reference to the accompanying soil map will show that a large majority of these marshy areas occur in the western part of the county. One area is found in Lincoln Township, upon the terrace of the Sioux sandy loam, where it is caused by the seepage of water from the gravel subsoils of a higher terrace maintaining a perpetual condition of saturation in the soil. With the exception of two small strips, one in Lime Creek and Mason townships and the other in Falls Township, there are no swampy areas of appreciable extent in the eastern part of the county.

It should be borne in mind that no attempt has been made to show upon the map all the areas of Muck which occur in the district surveyed, and that only such as occupy an area of 20 acres or more, and few less than 40 acres, have been mapped. For in certain localities hardly a quarter section can be found upon which there is not one or more of these little marshy depressions, filled with mucky soil and a dense growth of reeds and water-loving grasses.

The character of the material found in these boggy areas is somewhat variable. The earthy part may be made up largely of the finer silt and clay particles, or it may be largely sand, but there is always a

very large proportion of vegetable mold in the soil, giving the whole a black, mucky appearance, and a light woody texture. Sometimes decomposition has not progressed far enough to produce a true Muck, but the accumulation is more of the nature of peat. Mingled with the soil, fine flaky fragments of the shells of mollusks are found, in some cases so numerous as to give a decided marly character to the clay underlying the humus soil.

Only in the very driest seasons—such as occur once in a decade—are these areas capable of cultivation for crops. Occasionally corn is planted upon some of the driest, but by far the greater number are never used except for grazing and the production of hay. Little work has as yet been done to reclaim these areas. Some have been tiled, but owing to the lack of a good outlet ditch or faulty methods in locating the drains and laying the tile, the attempt has been only partly successful. When thoroughly drained and brought under cultivation, the mucky areas which are now a hindrance to agriculture should be valuable for hay production and for the growing of celery, onions, and similar crops.

MIAMI BLACK CLAY LOAM.

The Miami black clay loam is one of the least important of the soil types of Cerro Gordo County, covering in all only 4,032 acres. The soil is a black, plastic clay loam, sometimes containing a small quantity of fine sand, and always exceedingly rich in organic matter. When saturated with moisture it is quite heavy and claylike, but in a dry condition it becomes friable and loamy. The soil grows more dense with increasing depth, and usually at about 18 inches below the surface a brown or dark-drab clay is found, very sticky and plastic, and in many cases containing a great number of flaky fragments of shells.

This is the heaviest type of soil found anywhere within the district surveyed. No large areas of it occur, nor is it characteristic of any particular locality, but small patches are found in nearly all sections of the county. Many more occur than have been indicated upon the soil map, but these are too small to be drawn upon a map of the scale used in the soil survey.

The Miami black clay loam is always found to occupy low and generally level topography. To this fact it owes its origin and distinctive characteristics. In some instances it occurs in depressed areas in the upland, which are poorly drained. In other cases it is found in the low-lying country bordering the streams. In either case it has been formed by gradual accumulation of the finer material worked down from surrounding higher lands, and mingled with decaying organic material which has been supplied by the luxuriant growth of vegetation common to the moist conditions obtaining in such locations.

The natural drainage of this type of soil is always poor. In some cases artificial drainage has been employed, and wherever it is practicable to do so the land should be furnished with a complete system of tile drains. When thus improved it is a strong, productive soil, capable of producing heavy yields of grass, corn, oats, and buckwheat. It is especially adapted to grass, and should be used chiefly for the production of hay and for pasturage. In wet seasons corn is liable to injury from excess of water, and oats produces too heavy a growth of straw. Buckwheat, of the grain crops, and flax do fairly well upon this soil; they can be planted later in the season than other crops, which gives time for the naturally wet soil of this type to become dry.

The following table shows the texture of typical samples of the soil and subsoil of the Miami black clay loam:

Mechanical analyses of Miami black clay loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9507	Sec. 13, Owen T..	Clay loam, 0 to 18 inches.	7.49	1.76	7.10	6.36	9.70	4.60	40.58	29.90
9508	Subsoil of 9507....	Clay, 18 to 36 inches...	.50	1.30	6.50	6.54	10.00	6.30	46.40	22.90

MARSHALL SAND.

As found in Cerro Gordo County, the Marshall sand is a type of minor importance. Its area, as indicated upon the soil map, embraces only 1,024 acres, though there are a few scattered patches too small in themselves to be given a place upon a map of the scale in use in the soil survey. But while of minor agricultural importance, because of its limited extent, the Marshall sand is a perfectly distinct type, and is recognized as such by those who cultivate it.

The soil is a black or brown loamy sand of medium texture, inclined in some instances to be rather coarse. At a depth of about 14 inches it is underlain with a loose yellow or red-brown sand, similar in texture to the soil, but generally possessing less coherency. The loamy nature of the soil is due in part to the admixture of silt and clay particles, but chiefly to the presence of organic material. The content of humus decreases upon the crests of the knobs and ridges; the sand loses much of its coherency, and is so loose that when dry it is drifted by the wind. On the other hand, where the soil lies more level and is better watered, the sand is black and mellow.

The Marshall sand occurs as a very narrow ridge extending in a northwest-southeast direction through parts of Geneseo and Dougherty townships. In sections 33 and 34 of Dougherty Township the soil is typically developed, and here it spreads out over a broader area and is characterized by a somewhat hummocky topography. In a number of places the "ridge" has been excavated for the purpose of digging sand for building material. These pits show the deep subsoil to be a rather coarse light-yellow sand, and though it was impossible to see evidences of stratification, the sand itself is rounded as if it had been subjected to water action.

It is hard to say by what processes this soil was formed. It is undoubtedly of glacial origin, and was probably deposited at the front of the glacier by the melting ice, or was the accumulation of a subglacial stream or esker.

Owing to its open, porous structure the soil is uncertain in its crop yields. In a wet season all crops do well, but when the rainfall is at or below the average, most crops are likely to suffer from lack of moisture. The soil is well adapted to vegetables and melons, and the garden patch of the farm is usually located upon the "sand ridge," as it is locally known.

The following table shows the texture of typical samples of this soil:

Mechanical analyses of Marshall sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9505	Sec. 29, Dougherty T.	Medium loamy sand, 0 to 14 inches.	1.72	2.50	16.58	19.02	34.10	6.82	10.60	10.20
9506	Subsoil of 9505....	Sticky sand, 14 to 36 inches.	.64	2.10	15.84	17.96	34.76	7.18	12.60	9.40

MEADOW.

There are a few low-lying areas along some of the streams that are always wet and unfit for general agricultural purposes. The soil is of a variable character, ranging from a very sandy material to heavy clay loam, but always rich in organic matter. Portions of these Meadow areas are subject to occasional overflow in times of very high water. They are not adapted to cultivation, but furnish an excellent pasturage, while some wild marsh-grass hay is produced.

AGRICULTURAL CONDITIONS.

It would be evident to the casual observer, passing hurriedly through this part of Iowa, that agriculture in Cerro Gordo County is in a prosperous condition. From the car window the traveler looks out upon well-cultivated fields and pastures of bluegrass, where fine beef and dairy cattle are grazing. The barns and farm buildings are, as a rule, spacious and well kept; and often the country dwelling houses, equipped with all modern conveniences, have really more of the appearance of the homes of well-to-do citizens in our best country towns than of the typical farm house. The appearance of neatness and thrift about the country homes bespeaks the general prosperity and high average of intelligence and culture among the agricultural classes.

Compared with many parts of the country, there is little tenant farming in this section. The average size of the farm is about 160 acres, and nine out of every ten farmers own the farms they are cultivating. Often a farmer who wishes to cultivate a larger tract will rent additional land from a neighboring land owner for this purpose, but this is frequently because he can not buy the piece he desires.

Recently there has been observed somewhat of a tendency for those who have acquired a fair share of wealth to retire from the farm, move to town, and rent their land to tenants. Seldom will a tenant take the same care in the management of the farm and of the fertilizing of the soil as will the owner himself, whose interest it is to keep up the intrinsic value of his property.

The price of farm lands has increased quite rapidly during the last two decades. Fifteen or twenty years ago, in some parts of the county, farms sold for as low as $8 or $10 an acre, whereas now nothing is sold for less than $50, and much of the choice land will bring $75 or $80 an acre. Rent ranges from $2.50 to $3.25 an acre, and leasing is generally on a cash rather than on a share basis.

The labor problem is a serious one for the Cerro Gordo County farmer. Farm hands are generally efficient, but at times it is very difficult to obtain help, even by offering high wages. Where a laborer is hired for seven or eight months of the year, from $25 to $30 a month, with board, is usually paid, but when extra hands are needed to handle the heavy crops of hay and grain it is not uncommon to pay $2.50 or $3 a day for help. Yet, as long as the present extensive methods of farming are practiced, there is not so great a need for extra hands; the farmer himself with his boys can do most of the work on a farm of 80 or 100 acres.

The principal products of this county, as before stated, are grain, hay, and stock. Conditions seem eminently to favor these industries. The land lies well, and the soil is of a character which makes the use of machinery easy and extensive methods of agriculture profitable. From season to season the average yield of corn and oats is between

35 and 40 bushels per acre, while hay yields from 1½ to 2 tons per acre. Clover and timothy are the principal grasses sown for hay, but considerable millet is also produced, and in the low-lying areas a good deal of wild swamp grass is cut every season. Bluegrass grows luxuriantly upon all soils of the area, and with white clover forms fine pasturage for the many herds of cattle and sheep.

In a country where there is so little specialization of crops, and where the soils are so nearly alike, we should not expect to find much evidence of the adaptation of soils to special crops. However, it is the rule to use the low-lying wet areas for hay and pasture, while the better-drained upland is planted to the grain crops.

Although there are small patches here and there of different varieties of crops scattered throughout the county, corn, oats, timothy, and clover occupy the greater number of the cultivated fields. There is less diversity, indeed, than might be desired. Flax, barley, rye, buckwheat, sorghum, and millet are field crops that are grown to a limited extent. Vegetables and the common fruits are raised for home consumption on nearly every farm, and in the neighborhood of Mason City there are a number of fruit and truck farms carried on upon a paying basis to supply the local market.

Of the fruits that are best adapted to conditions here, apples, plums, cherries, and grapes may be mentioned. The climate is too severe for peaches.

Stock raising is now, and long has been, one of the greatest sources of revenue to the farmer of this community. A large part of the products of the soil is fed to cattle and hogs, and thus the produce of the land is largely kept on the farm. As a rule good grades of beef cattle are kept, chief among which are the Shorthorn, Angus, Hereford, and Galloway. There were a number of stock farms noted, where thoroughbred stock was raised for local sale. This is a tendency in the right direction, for it has been demonstrated again and again that it pays to keep a standard, thoroughbred grade of farm animals.

Dairying is carried on to a considerable extent, though it is usually made subordinate to beef making. In many cases a combination of these two interests is successfully accomplished. By crossing, a strain of dairy cattle is produced, which at the same time make good beef producers. The cream is separated on the farm, churned, and sold on the local or eastern market, while the skim milk is fed to fattening calves while it still retains its animal warmth. In a few cases ensilage is fed to the dairy herd, but as yet the silo has not come into so general use here as in many parts of the country. In fact, until recently much of the corn fodder was left standing in the field, and no attempt was made to save it for winter forage; but the farmers are coming more and more to appreciate its value as feed, and in spite of the cost of cutting and shredding they are beginning to save this hitherto neglected product of the farm.

In many cases the silo would be a great help in saving the feeding value of a late corn crop, as, for instance, in the season just closing (1903), which has been so wet and cold that a great deal of the corn can never mature. Much of the feeding value of this crop might have been saved by cutting the corn green and storing it in silos. The recently conducted experiments in Kansas and Michigan have tended to prove pretty conclusively that corn silage is a superior feed for fattening steers.

On the whole, good cultural methods are practiced in handling the soil. Though no systematic rotation is followed generally, it is customary to alternate the crops grown upon a given field, and to seed it down periodically to clover and other grasses. The Iowa farmer realizes the value of stable and barnyard manure in maintaining a high state of productiveness in the soils, and large quantities are spread upon the land each year. The straw and chaff of the oats, of which there is an immense quantity every season, are strewn in the barnyard and mixed with the stable manure. Thus the organic constituents of the soil are replenished from year to year, and with continued care in the future there is little likelihood of the land declining appreciably in productivity.

The matter of drainage presents many perplexing problems to the Cerro Gordo County farmer. Especially is this true in the western part of the county, where there are innumerable little ponds and sloughs with no natural outlet. A good deal of the land is already tiled, but much more is still undrained; and in some cases, until an adequate outlet ditch is furnished, tile drains would be ineffective. As it is now, the farmer must often run his outlet drain a considerable distance to obtain the requisite fall, and this at a considerable cost. Where the area to be drained is small, this may sometimes be poor policy, for the value of the land when improved may not warrant the outlay for reclamation. A system of drainage for such areas has been tried in the neighborhood of Thornton, in some cases with marked success. This is the method of draining by wells. A well is sunk after the ordinary method of drilling wells until a good flow of water is obtained. The well is then lined with pipe casing, and the tile lines led into a box, sunk 5 or 6 feet into the ground at the well opening. Such a drain, it is claimed, will carry off an amount of water equivalent to the flow of water in the well. Though only a few such drains have been put into actual trial in the area, it is to be expected that they will be a useful means of reclaiming many small, swampy areas where the ordinary methods would be too expensive for practical use.

In other parts of the county, too, there is much of the land that would be improved by thorough underdrainage, and, indeed, many of the farms are well equipped with a good system of tile drains.

As previously stated, Cerro Gordo County is well supplied with railway lines for the transportation of its produce to the markets. The Chicago and Northwestern, the Chicago, Milwaukee and St. Paul, the Chicago Great Western, and the Iowa Central railroads center at Mason City, and the Burlington, Cedar Rapids and Northern traverses the northeastern section of the county. Nearly every township is traversed by one or two lines of railway, and all parts of the county are within a few miles of some railroad station. The country roads leave much to be desired, however. In some seasons of the year they are so soft that hauling is next to impossible. In some sections gravel has been used on the roads, and the condition of the more important highways has been very much improved in this way.

In connection with the discussion of trade and markets, mention should be made of a cooperative organization of farmers which is in successful operation in one section of the county. This is known as the "Farmers' Cooperative Association," and has its headquarters at Rockwell. The object of this organization is to market the farmer's produce and purchase his needed supplies without the help of the "middlemen." The company owns its own elevator for handling grain. The plan and organization of this association is considered nearly perfect, and it has become known throughout the country, where other similar companies have been organized and are in successful operation.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF

SOIL MAP

IOWA
CERRO GORDO COUNTY SHEET

SOIL PROFILE
(3 feet deep)

Marshall sand — Ssc / S

Sioux sandy loam — Ssc / Scc

Marshall loam — Ssc / Scc / C

Marshall clay loam — Sac / Scc

Miami black clay loam — Scc / Scc

Meadow

Muck

LEGEND

Ssc Sandy loam
S Sand
Scc/S Sandy clay loam
C Clay
Sac/F Fine sandy loam
Scc Clay loam

LEGEND

Ms Marshall sand
Sl Sioux sandy loam
Ml Marshall loam
Mc Marshall clay loam
Mcl Miami black clay loam
M Meadow
Mu Muck

Soils surveyed by
Herbert W. Marean and
Grove B. Jones
1903.

Scale 1 inch = 1 mile

A. Hoen & Co. Lith. Baltimore, Md.

Field Operations
Bureau of Soils
1903.